

Conference Abstract

The Canadian Genomic Adaptation and Resilience to Climate Change (GenARCC) Project

James A Macklin[‡], Tony Kess[§], Satpal Bilkhu[‡], Ian Bradbury[§]

[‡] Agriculture and Agri-Food Canada, Ottawa, Canada

[§] Fisheries and Oceans Canada, St. John's, Canada

Corresponding author: James A Macklin (james.macklin@agr.gc.ca)

Received: 24 Nov 2025 | Published: 26 Nov 2025

Citation: Macklin J, Kess T, Bilkhu S, Bradbury I (2025) The Canadian Genomic Adaptation and Resilience to Climate Change (GenARCC) Project. Biodiversity Information Science and Standards 9: e180293.

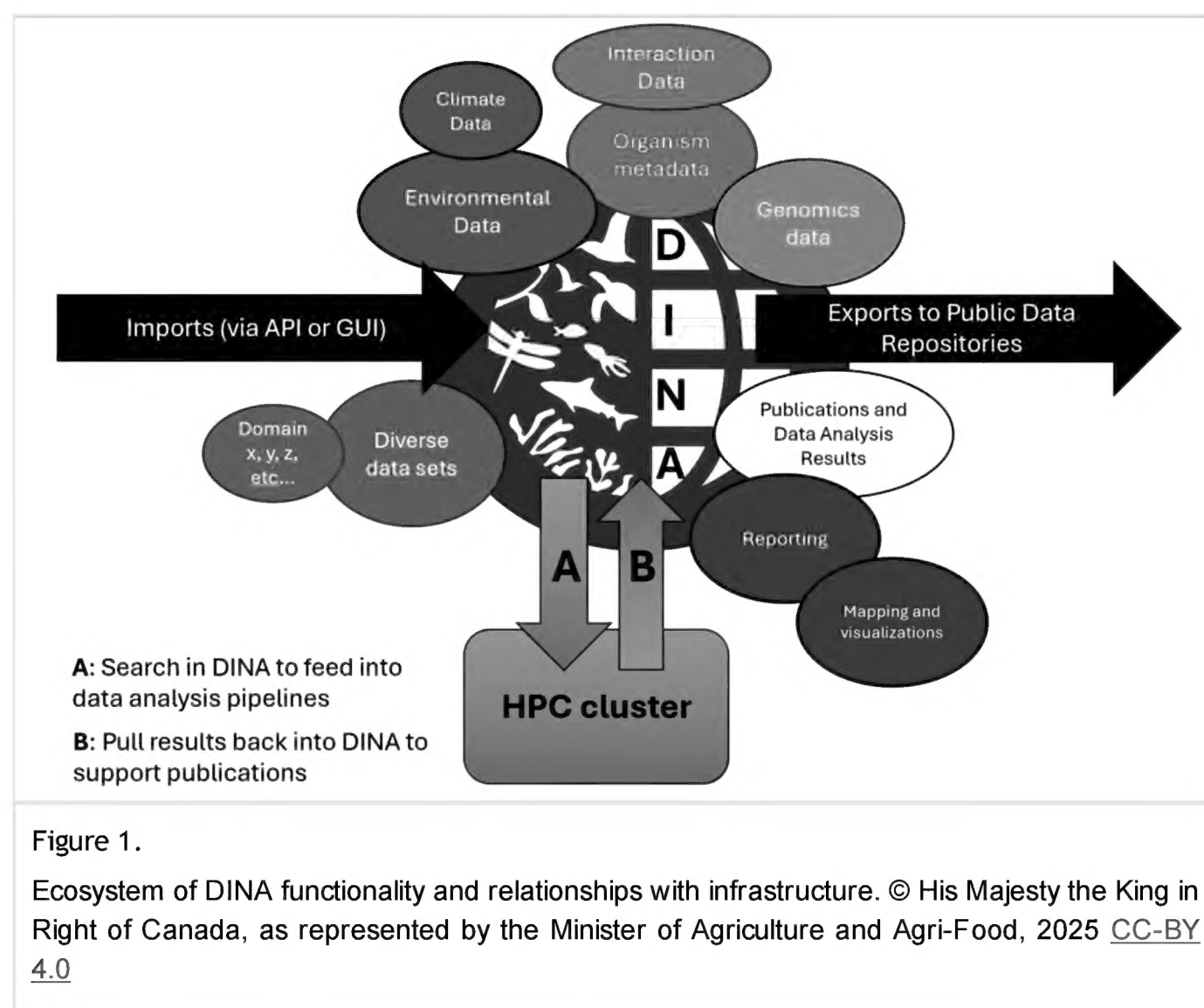
<https://doi.org/10.3897/biss.9.180293>

Abstract

Genomic technologies provide the highest resolution molecular information on species biology, and can help us understand risks and potential for adaptation among species in a changing environment. The Genomic Adaptation and Resilience to Climate Change (GenARCC) project uses molecular tools to identify ecosystem composition, pathogen and pest prevalence, and adaptive capacity within species. This Government of Canada project purposefully takes a multi-department/agency approach, drawing on complementary expertise and centralized infrastructure to address the complexity of climate change spanning multiple levels of trophic and taxonomic diversity. The GenARCC project's goal is to develop capacity to use genomics to assess, predict, and adapt to climate change for the protection of Canada's biodiversity, ecosystem resilience, food security, and health. Together, the data and expertise generated in this project represent the largest single national effort and combined dataset to address climate change impacts across species and ecosystems with molecular data. GenARCC comprises research across a diversity of environments and species, covering forest and tundra, arctic, marine, and agricultural ecosystems. Genomic, climate and phenomic datasets have been generated and centralized to better understand impacts to biodiversity across biological levels of organisation.

To facilitate storage and analysis of this data, we have deployed a common high performance compute environment allowing participants across multiple Canadian

departments and agencies to leverage shared infrastructure, datasets and workflows. Project outputs and inputs are managed through a dedicated sample data research management platform, [DINA](#) (Fig. 1). DINA utilizes a highly flexible data model with a core set of fields that can be extended using domain-based standards as field-extensions and/or managed attributes that are user defined, with both able to leverage controlled vocabularies. Strong process-based provenance is maintained for samples and their derivatives. Samples managed, for example, range from individual specimens of bacteria and viruses, plants, insects, fish, and mammals to environmental samples of soil, water, and external and internal microbiomes. A robust API facilitates data migration and customized export supporting data analysis and publication ([GitHub Repo](#)). The project has produced several standardized pipelines using Snakemake and Nextflow for efficiency and ease of comparison. An effort was also made to standardize Canadian climatic data for modelling allowing for cross-species comparisons (Marquis 2024).



Additionally, project participants benefit from [training on scientific computing](#), as well as genomic methods in discussion forums for data analysis and integration best practices. This access to computing resources and training has supported publication of more than 30 studies that can be found on the [GenARCC publication website](#). Results from this project will inform evidence-based policy to support conservation of biodiversity, as well as management of natural resources and key species across ecological realms.

Keywords

forecasting, risk, environment, DINA, species, ecosystem, molecular, Canada, data management

Presenting author

James A Macklin

Presented at

Living Data 2025

Funding program

Funded by the Government of Canada through the Genomics Research and Development Initiative – GenARCC project, 2022-2027

Conflicts of interest

The authors have declared that no competing interests exist.

References

- Marquis B (2024) Canada wide monthly bioclimate data generated using the BioSim software from 1980-2020. <https://doi.org/10.20383/103.01119>. Accessed on: 2025-9-26.